SD0809 Requirements Capture

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working with David Rogers

Introduction

A directional coupler is a passive device which couples part of the transmission power by a known amount through another port, often by using two transmission lines set close enough together such that energy passing through one is coupled to the other.

Directional couplers are invaluable components for measuring the power levels of signals in microwave systems. Especially when high power levels are involved, a properly designed directional coupler provides a lower-power coupled signal that is within the power measurement range of a power meter or spectrum analyzer. By applying the finite-element method (FEM) of analysis, it is possible to effectively analyze and design directional couplers for high-power applications, taking into account the effect of metallic diaphragms that partially separate the coupler inner conductors. Based on input power, directional coupler can be divided into two categories low power and high power. Designing a low power directional coupler is our prime area of concern.

Project Statement and Requirement

The primary goal of this project is to design and construct three or four devices that measure the VSWR in the frequency range 1.8 to 144 MHz .Basically each of these devices will be appropriate for the class room demonstration of the concepts of VSWR, forward power, reverse power and/or related concepts. Common properties desired for all directional couplers are wide operational bandwidth, high directivity, and a good impedance match at all ports when the other ports are terminated in matched loads. These performance characteristics play vital role for the accuracy of the directional couplers and our main focus will be to achieve accuracy that can compete with those available in the market. Out of these four directional couplers the first device will be based on simple principles, that is, it might just provide a

good estimate of VSWR.

The second through third or fourth devices will use the principles of a directional coupler and will provide measurement of both the forward power and reverse power in the transmission line. The different devices might include different methods due to the wide frequency range.

All these devices will be designed to handle up to 5 Watts of total power and should be appropriate for 50 ohm devices and transmission line. The outputs of the devices should be analog. But more emphasis will be given to make it digital and complementary digital outputs will also be included.

Each of the previous requirements are subject to review and comment by Professor David Rogers and may therefore change.

If time and resources permit, several secondary requirements will be considered for implementation:

1. The last device will be constructed using an open wire line that will demonstrate an actual voltage standing wave and allow for direct measurement of VSWR.

2. MATLAB interface/direct programming. Develop algorithms using a MATLAB interface or through direct programming showing clear working.